Sherman Lam (sherman1)
Logan Ellis (ANDREW ID)
Jack Buffington (ANDREW ID)
16720 CV
October 11, 2016

3D Scene Reconstruction from Single Moving Camera

1 Project Overview

3D scene reconstruction is useful in robotics for understanding a robot's environment can aid in navigation through this environment. One typical approach is to use simultaneous localization and mapping (SLAM) to create a map from laser scanners, inertial measurement units, and GPS. However, these devices require specialized hardware to interface and control.

The goal of this project is to reconstruct 3D scene using video from a standard smart phone camera. Newcombe and Davison present an algorithm that efficiently does by tracking keypoints in sequential frames of the video, predicting camera poses using structure from motion (SFM), and correcting these camera poses using optical flow. Using these poses, it fits a 3D model of the world to sequential frames of the video [3]. This builds upon the work of [1], [2], and [4].

2 Technology

No specialized technology is needed - only a cell phone and laptop.
Topics we'll be addressing are structure from motion, optical flow, and SLAM.

3 Timeline

References

[1] Andrew J Davison. Real-time simultaneous localisation and mapping with a single camera. In *Computer Vision, 2003. Proceedings. Ninth IEEE International Conference on*, pages 1403–1410. IEEE, 2003.

[2] Georg Klein and David Murray. Parallel tracking and mapping for small ar workspaces. In *Mixed and Augmented Reality, 2007. ISMAR 2007. 6th IEEE and ACM International Symposium on*, pages 225–234. IEEE, 2007.

[3] Richard A Newcombe and Andrew J Davison. Live dense reconstruction with a single moving camera. In *Computer Vision and Pattern Recognition (CVPR), 2010 IEEE Conference on*, pages 1498–1505. IEEE, 2010.

[4] Marc Pollefeys, David Nistér, J-M Frahm, Amir Akbarzadeh, Philippos Mordohai, Brian Clipp, Chris Engels, David Gallup, S-J Kim, Paul Merrell, et al. Detailed real-time urban 3d reconstruction from video. *International Journal of Computer Vision*, 78(2-3):143–167, 2008.